UNIVERSITI PUTRA MALAYSIA

DEVELOPMENT OF TECHNOLOGY TRANSFER MODEL WITH ENABLING PERFORMANCE FACTORS FOR THE LIBYAN PETROLEUM INDUSTRY

AL MABRUK S. MOHAMED

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By

AL MABRUK S. MOHAMED

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Doctor of Philosophy

October 2010

DEDICATION

This thesis is dedicated to my wonderful parents, who have raised me to be the person I am today. You have been with me every step of the way, through good times and bad. Thank you for all the unconditional love, guidance, and support that you have always given me, helping me to succeed and instilling in me the confidence that I am capable of doing anything I put my mind to. Thank you for everything.

I also want to dedicate this thesis especially to my precious wife, my dearest daughter Jude, and my cheering son Mohamed. Without my wife help and encouragement it simply never would have been.

Final dedication goes to a friend and mentor memory, my uncle the late colonel Abdul Salam Sultan, may his soul rest in peace.

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Doctor of Philosophy

DEVELOPMENT OF TECHNOLOGY TRANSFER MODEL WITH ENABLING PERFORMANCE FACTORS FOR THE LIBYAN PETROLEUM INDUSTRY

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October 2010

Supervisor: **Professor Mohd Sapuan b Salit, PhD, PEng.**

Faculty: **Institute of Advanced Technology**

Technology Transfer (TT) is increasingly being used on petroleum industry. The evaluation of TT significant indicators and their effect on TT performance for Libyan petroleum industry were investigated. The study main objective is to develop a TT model for the Libyan oil industry with performance factors.

This study defined four categories of enabling factors that could have an effect on the TT process and its results for the petroleum industry: TT support, TT infrastructure, industry learning capability, and TT environment. The resultant TT performance and the relationship between enabling and performance factor give the level of TT performance to local petroleum industry through the TT process. Realizing the study objective would require requesting the petroleum industry input through questionnaire surveys in pilot, main studies, and validated by case studies.

For the main study, 300 questionnaire surveys were distributed and 205 were collected, offering a response rate of 68 per cent. Statistical analysis techniques, including, Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM) were used to examine the survey data. Analysis resulted in a TT model encompassing three TT enabling factors, namely, government support, host characteristics, technology learning capability, and the resultant performance factor named TT performance.

The baseline formulation for standardization of TT measurement in the petroleum industry was undertaken using series of measurements. Case studies from three Libyan companies involved with foreign partners were applied to validate the standardization.

The study provided evidence that the UK is the leading petroleum investor in Libyan petroleum industry. However, at TT performance perspective, German and Italian corporations have the leading edge on TT petroleum projects.

TT model was created to help both researchers and practitioners to understand the TT process in petroleum industry. The model provided an evident design on main variables influenced TT issues. The structural model consisted of four factors and five paths, representing the interrelationships between the four enabling and one outcome factor. Positively, the research results empirically validated that factors referring to technology learning capability, technology characteristics, and technology support could be incorporated to evaluate the TT performance.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebgai memenuhi keperluan untuk ijazah Doktor Falsafah.

PEMBANGUNAN MODEL PEMINDAHAN TEKNOLOGI DENGAN FAKTOR PRESTASI BAGI INDUSTRI PETROLEUM LIBYA

Oleh

AL MABRUK S. MOHAMED

Oktober 2010

Penyelia: Profesor Mohd Sapuan b Salit, PhD, PEng.

Fakulti: Institut Teknologi Maju

Pemindahan Teknologi (PT) semakin banyak digunakan dalam industri petroleum. Penilaian petunjuk signifikan PT dan kesannya terhadap prestasi PT untuk industri petroleum Libya diselidiki. Tujuan kajian utama adalah untuk membangunkan model PT untuk industri minyak Libya dengan faktor prestasi.

Kajian ini menetapkan empat kategori faktor pendukung yang mempengaruhi proses PT dan hasilnya untuk industri petroleum: sokongan PT, infrastruktur PT, kemampuan pembelajaran industri, dan persekitaran PT. Keputusan prestasi PT dan hubungan antara pembolehan dan faktor prestasi memberikan tingkat prestasi PT untuk industri minyak tempatan melalui proses PT. Untuk mencapai objektif kajian memerlukan input industri petroleum melalui rintis borang soal selidik, kajian utama, dan pengesahan melalui kajian kes.

Untuk kajian utama, 300 tinjauan soalselidik telah diedarkan dan 205 dikumpulkan, memberikan kadar maklumbalas sebanyak 68 peratus. Teknik analisis statistik, termasuk, Analisis Faktor Tinjauan (EFA), Analisis Pengesahan Faktor (CFA) dan

Pemodelan Persamaan Struktur (SEM) digunakan untuk mengkaji data kaji selidik. Hasil analisis model PT mengandungi tiga faktor pemboleh, seperti sokongan kerajaan, ciri-ciri hos, dan kebolehan pembelajaran teknologi, manakala hasilan faktor prestasi dinamakan prestasi PT.

Rumusan asas untuk piawaian pengukuran PT dalam industri petroleum dijalankan menggunakan siri-siri pengukuran. Kajian kes daripada tiga syarikat Libya terlibat dengan rakan asing telah dilaksanakan untuk mengesahkan piawaian.

Kajian ini memberikan bukti bahawa UK adalah pelabur petroleum yang terkemuka dalam industri petroleum Libya. Namun, pada perspektif prestasi PT, Jerman dan syarikat Itali merupakan pendahulu kepada projek-projek petroleum PT.

Model PT diciptakan untuk membantu penyelidik dan pengamal untuk memahami proses PT dalam industri petroleum. Model ini memberikan rekabentuk yang nyata pada pembolehubah utama yang mempengaruhi masalah PT. Model struktur terdiri daripada empat faktor dan lima laluan, yang mewakili hubungan timbal balik antara empat pembolehan dan salah satu faktor hasil. Secara positif, hasil kajian membuktikan secara empirik bahawa faktor yang merujuk pada kemampuan teknologi pembelajaran, ciri-ciri teknologi, dan sokongan teknologi boleh digabungkan untuk menilai prestasi PT.

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In the Name of Allah, Most Gracious, Most Merciful, all praise and thanks are due to Allah, and peace and blessings be upon His Messenger. I would like to express the most sincere appreciation to those who made this work possible: supervisory committee and my family.

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I am deeply grateful to the supervisory committee members, Professor Megat Mohamad Hamdan B Megat Ahmad, Dean of Faculty of Engineering, National Defence University of Malaysia for his detailed and constructive comments, and for his important support throughout this work. In addition, I wish to express my warm and sincere thanks to Professor Abdel Majid Salem Hamouda, Head of the Department of Mechanical & Industrial Engineering, College of Engineering, Qatar University who introduced me to the field of technology transfer and Dr. B.T. Hang Tuah Bin Baharudin, senior lecturer at Mechanical and Manufacturing Engineering, Faculty of Engineering, University Putra Malaysia. Their ideals and concepts have

had a remarkable influence on my entire career in the field of technology transfer modeling.

The questionnaire surveys and case studies for this research were facilitated by numerous employees and respondents in the Libyan petroleum industry. I am extremely grateful for all of them. Without their support and hard work this study would not have been possible.

Thanks and acknowledgements are meaningless if not extended to my parents who deserve my deepest appreciation. I am grateful for the countless sacrifices they made to ensure that I could pursue my dreams and for always being there for me. Real and deepest thanks to them (May ALLAH bless and protect them and may live long and healthy life). All praise and thanks words said to them will not be enough.

I owe my loving thanks to my wife, my daughter Jude and my son Mohamed. They have lost a lot due to my research time. Without their encouragement and understanding it would have been impossible for me to finish this thesis. My special gratitude is due to my brothers, my sisters and their families for their support.

The Libyan government scholarship is gratefully acknowledged.

APPROVAL SHEETS

I certify that an Examination Committee has met on **08/10/2010** to conduct the final examination of **Al Mabruk S. Mohamed** on his PhD thesis entitled **" Development of Technology Transfer Model with Performance Factors for Libyan Petroleum Industry"** in accordance with Universiti Pertanian Malaysia (HIGHER Degree) Act 1980 and Universiti Pertanian Malaysia (High Degree) Regulation 1981. The committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfillment on the requirement for the degree of Doctor of Philosophy. The members of the supervisory committee were as follows:

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Professor and Dean
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Date:

DECLARATION

I declare that the thesis is my original work except for quotations and citations, which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or other institutions.

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ALMABRUK S. MOHAMED

Date: **08/10/2010**

TABLE OF CONTENTS